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Development of Foam Ceramics Manufacturing Technology

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EXTENDED ABSTRACT

Both dense and porous construction materials are widely used in civil and industrial construction. For example, lightweight concrete, cellular concrete, foam concrete and other types of lightweight concrete are used almost as widely as conventional concrete. However, for the production of walls made of ceramic materials, bricks with dense structure and hollow bricks still are the most popular building materials.

Lower expenses related to the production of building materials having necessary properties will lead to decreased production costs allowing to increase the production capacity due to the economy of raw materials, other materials and fuel.

According to the calculations, today, when the thermal resistance for wall structures has increased 2.5-3 times, having an average density of wall material 900-1100 kg/m3 it is no longer possible to meet the requirements for the thermal resistance of the outer walls 460-520 mm in the climatic conditions of the Baltic region. It is necessary either to increase wall thickness or to use more efficient insulation materials which both are not cost-efficient solutions. One of the possible solutions for the given problem is reduction of the average density for the wall material.

Economic efficiency due to the reduction of average density for the wall material is the following: production capacity of the material decreases, fuel consumption in the production process of blocks or bricks decreases, energy consumption on bricklaying for 1 m2 of the outer wall decreases; less manual work, depending on the wall thickness, heat resistance in walls of the building increases.

One of the most ecological and efficient methods is foaming of ceramic slip mass; therefore this technology has been chosen for the given research focusing on the production method of porous ceramics by using foaming of ceramic slip mass.

The goal of present investigation is elaborating technology and mix content for producing foam ceramic. After summarizing the theoretical material about foam ceramic production technology development, the compositions of raw materials were designed. It contain seven components: clay (100%), forming sustainable structure and strength as the main raw material; liquid glass and soda (5% and 0.2% of the clay mass) acting as electrolytes to increase the fluidity of the clay slips, to facilitate the foam introduction into the slips; foaming agent (0.09% of the clay mass) - forming the porous structure of material; polypropylene fibers and sawdust (2% of the clay mass) as structural stabilizers reducing drying shrinkage; and forming moisture - water (60% of the clay mass) intended for softening of raw material, dilution of electrolytes and for foaming of foaming agents.

According to the research about firing process, an optimal firing temperature is 980-1050 °C (Черных, 2003). Based on previous studies about conducted on the respective clay (see table 1) firing temperature 1000 °C has been selected in a given research. Porous ceramics with volume mass ranging from 341 – 799 kg/m3, porousity 25-85 % and compressive strength 0.5 – 1.1 MP was obtained. The different physico-mechanical properties of the specimens were tested: compressive strength, bulk density and water absorption. In the framework of this research porous ceramic material with improved properties has been obtained and production technology of the material has been developed.

Keywords: *foam ceramics, ecological material, insulation material, porous ceramics.*

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